

Education Longitudinal Study of 2002 (ELS:2002)

Website: <https://nces.ed.gov/surveys/els2002>

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1. OVERVIEW

The Education Longitudinal Study of 2002 (ELS:2002) represents a major longitudinal effort designed to provide trend data about critical transitions experienced by students as they proceed through high school and into postsecondary education or their careers. The 2002 sophomore cohort is being followed, initially at 2-year intervals, to collect policy-relevant data about educational processes and outcomes, especially as such data pertain to student learning, predictors of dropping out, and high school effects on students' access to, and success in, postsecondary education and the workforce.

In the spring term of 2002 (the base year of the study), high school sophomores were surveyed and assessed in a national sample of high schools with 10th grades. Their parents, teachers, principals, and librarians were surveyed as well.

In the first of the follow-ups, base-year students who remained in their base-year schools were resurveyed and tested (in mathematics) 2 years later, along with a freshening sample that makes the study representative of spring 2004 high school seniors nationwide. Students who had transferred to a different school, switched to a homeschool environment, graduated early, or dropped out were administered a questionnaire. In the second follow-up in 2006, information was collected through a single electronic questionnaire about colleges applied to and aid offers received, enrollment in postsecondary education, employment and earnings, and living situation, including family formation.

The third follow-up data collected in 2012 support further investigations: persistence in attaining postsecondary educational goals; rate of progress through the postsecondary curriculum; degree attainment; barriers to persistence and attainment; impacts of educational indebtedness; entry of new postsecondary graduates into the workforce; social and economic rate of return on education to both the individual and society; and adult roles, such as family formation and civic participation.

Purpose

ELS:2002 is designed to monitor the transition of a national sample of young people as they progress from 10th grade through high school and on to postsecondary education and/or the world of work.

Components

ELS:2002 has two distinctive features. First, it is a longitudinal study in which the same units are surveyed repeatedly over time. Individual students will be followed for more than 10 years; the base-year schools were surveyed two times, once in 2002 and again in 2004. Second, in the high school years, it is an integrated multilevel study that involves multiple respondent populations. The respondents include students, their parents, their teachers, their librarians, and their schools.

LONGITUDINAL SAMPLE SURVEY OF THE 10TH GRADE CLASS OF 2002; BASE- YEAR SURVEY, FIRST FOLLOW-UP IN 2004, SECOND FOLLOW-UP IN 2006, AND THIRD FOLLOW-UP IN 2012

ELS:2002 collects data from:

- Students and dropouts
- School administrators
- Library media staff
- School facility checklist
- Parents
- High school transcripts

Base-year survey. The base-year (2002) data collection instruments for ELS:2002 consisted of five separate questionnaires (student, parent, teacher, school administrator, and library media center), two achievement tests (assessments in reading and mathematics), and a school observation form (facilities checklist).

Student questionnaire. The student questionnaire gathered information about the student's background, school experiences and activities, plans and goals for the future, employment and out-of-school experiences, language background, and psychological orientation toward learning. The student questionnaire was divided into seven sections: (1) locating information, (2) school experiences and activities, (3) plans for the future, (4) non-English language use, (5) money and work, (6) family, and (7) beliefs and opinions about self. Assessments in reading and mathematics were given at the same time. The baseline scores for the assessments can serve as a covariate or control variable for later analyses. Mathematics achievement was reassessed 2 years later, so that achievement gain over the last 2 years of high school could be measured and related to school processes and mathematics coursetaking.

Parent questionnaire. One parent of each participating sophomore was asked to respond to a parent survey. The parent questionnaire was designed to gauge parents' aspirations for their child and to collect information about the home background and home education support system, the child's educational history prior to 10th grade, and parents' interactions with and opinions about the student's school.

Teacher questionnaire. For each student enrolled in English or mathematics, a teacher was also selected to participate in a teacher survey. The teacher questionnaire was designed to illuminate questions on the quality, equality, and diversity of educational opportunity by obtaining information in two content areas: the teacher's evaluations of the student and information about the teacher's background and activities.

School administrator questionnaire. The school administrator questionnaire collected information on school characteristics, student characteristics, teaching staff characteristics, school policies and programs, technology, and school governance and climate. The school administrator data can be used contextually, as an extension of the student data, when the student is the fundamental unit of analysis. At the same time, the data from the school administrator questionnaire are nationally representative and can be used to generalize to the nation's regular high schools with sophomores in the 2001–02 school year.

Library media center questionnaire. For the school library media center component, the school librarian, media center director, or school administrator supplied information about library media center size, organization, and staffing; technology resources and electronic services; the extent of library and media holdings, including both collections and expenditures; and levels of facility utilization, including scheduling for use by students and teachers. Finally, the questionnaire supplied information about the library media center's use in supporting the school's curriculum; that is, how library media center staff collaborate with and support teachers to help them plan and deliver instruction. Information in the library media center questionnaire can be used as contextual data with the student as the unit of analysis or to generalize to libraries within all regular high schools with 10th grades in the United States in the 2001–02 school year.

School facilities checklist. The facilities component comprised a checklist to be completed by the survey administrator. The survey administrator was asked to observe a number of conditions at the school, including the condition of the hallways, main entrance, lavatories, classrooms, parking lots, and surrounding neighborhood. Of special interest were indicators of security (metal detectors, fire alarms, exterior lights, fencing, security cameras, etc.) and maintenance and order (trash, graffiti, clean walls and floors, noise level, degree of loitering, etc.). Information gathered in the facilities checklist can be used as contextual data with the student as the unit of analysis, or data can be used at the school level to generalize to all regular high schools with 10th grades in the United States in the 2001–02 school year.

First follow-up survey. The first follow-up (2004) survey comprised seven questionnaires and an achievement test in mathematics. The questionnaires included a student questionnaire, a transfer student questionnaire, a new participant supplement questionnaire (NPSQ) (repeating selected questions from the base year), a homeschool student questionnaire, an early graduate questionnaire, a dropout (not currently in school) questionnaire, and a school administrator questionnaire.

Student questionnaire. The student questionnaire was administered to sophomore cohort members who had remained in their base-year school as well as to a freshening sample of 12th-graders in the same schools. Students who completed the student questionnaire also were normally eligible for the first follow-up mathematics assessment. Some students were administered an abbreviated version of the questionnaire. The full questionnaire comprised eight content modules: (1) contact information in support of the longitudinal design; (2) the student's school experiences and activities, including information about extracurricular participation, computer

use in English and math, the transition process from the sophomore year to upper-level secondary school, and the relationship of curricular programs and coursetaking to educational achievement and persistence; (3) time usage on homework, TV viewing, video and computer games, computers, nonschool reading, library utilization, and other activities; (4) plans and expectations for the future, including students' educational and life goals and values; (5) education after high school; (6) plans for work after high school; (7) work status and history; and (8) community, family, and friends.

Transfer student questionnaire. Sophomore cohort members who had transferred out of their base-year school to a new school received the transfer student questionnaire. Transfer students were asked a subset of items from the student questionnaire covering the following topics: school experiences and activities; time use; plans and expectations for the future; education after high school; work after high school; and community, family, and friends. In addition, transfer students were asked when they transferred and their reasons for doing so. Transfer students did not complete a cognitive test, but their test scores have been imputed.

New participant supplement questionnaire (NPSQ). Any student new to the study at any of the core (base-year) schools was administered the NPSQ. The NPSQ gathered information (that had been collected for other students in the base year) on new participants' demographic characteristics, parental education and occupation, and language use. In addition, a subset of items included in the student questionnaire was also posed to new participants. These items (which are identical in content to those in the abbreviated student questionnaire) relate to topics such as school experiences and activities; time use; plans and expectations for the future; education and work after high school; and work, community, family, and friendship experiences. In contrast, the New Participant Supplement (NPS) gathered the key base-year variables that also were included in the NPSQ.

Homeschool student questionnaire. ELS:2002 does not provide a representative sample of homeschooled high school students. (In the base year, all study sophomores were selected from regular U.S. high schools.) Instead, homeschooled students in ELS:2002 generalize only to sophomores in regular high schools in the spring term of 2002 who were in a homeschool situation 2 years later. Homeschooled students were asked about their schooling activities and status, including their grade, coursework completed in science and math, and steps taken toward college; how they spend their time; their plans and expectations for the future, including education and work after high school; work experiences; and community, family, and friends.

Early graduate questionnaire. Early graduates were defined as sophomore cohort members who had graduated from high school or received a General Educational Development (GED) credential on or before March 15, 2004. Early graduates completed only a subset of the items in the student questionnaire, complemented by additional items pertaining to their situation. More specifically, early graduates were asked with whom they consulted when deciding to graduate early, the basis for that decision, and the means by which they did so. They also provided a history of their work and educational experiences since leaving high school.

Dropout questionnaire. Dropouts were defined as sophomore cohort members who were out of school in the spring term of 2004, who had not received a high school diploma or GED credential, and who had missed 4 or more consecutive weeks to a cause other than accident or illness. There was considerable overlap between the student and dropout questionnaires; both collected locating information for longitudinal follow-up and included items on school experiences and activities, time use, plans and expectations for the future, and the type and amount of work in which dropouts were engaged. The dropout questionnaire gathered information about students' work status and history, volunteer work or community college experience, and the educational behavior of friends. In the area of school experiences and activities, dropouts were asked questions about the school they last attended and their participation in alternative education programs. In addition, they were asked to supply their specific reasons for leaving school prior to graduation. They were asked as well about plans to get a GED or return to high school.

School administrator questionnaire content and content linkages. The school administrator questionnaire collected information on the school in four areas: school characteristics, structure, and policies; student characteristics and programs; teacher and library staff characteristics; and principal reports on the school environment. It should be noted that school-level data are not nationally representative of American high schools in 2004, since the first follow-up sample did not factor in "births" of new schools and "deaths" of existing schools between 2002 and 2004. First follow-up school data, however, do provide a statistical portrait of a nationally representative sample of American high schools with 10th grades in 2002 (2 years later).

Second follow-up survey. The second follow-up (2006) survey was a single electronic questionnaire administered in three modalities—a web-enabled self-administration, computer-assisted telephone interviewing (CATI), and computer-assisted personal interviewing (CAPI). (Both CATI and CAPI are interviewer-administered modalities.) The questionnaire covered the transition from high school

to postsecondary education, and included items on college access and choice. Items were drawn from a number of studies, including the Baccalaureate and Beyond Longitudinal Study (see B&B chapter), Beginning Postsecondary Students Longitudinal Study (see BPS chapter), High School and Beyond Longitudinal Study (see HS&B chapter), National Education Longitudinal Study of 1988 (see NELS:88 chapter), and National Postsecondary Student Aid Study (see NPSAS chapter). The interview was organized into four substantive sections: *High School*, *Postsecondary Education*, *Employment*, and *Community*. The interview concluded with a *Locating* section.

The first section, *High School*, collected retrospective information about high school completion. Respondents were classified as spring-term 2004 12th-graders, spring-term 2004 dropouts, neither, or both (for a small set). The majority of respondents skipped this section entirely because their high school completion date and the type of high school credential they earned were preloaded into the instrument at the start of data collection.

The *Postsecondary Education* section of the interview, the point of entry for most respondents, focused on education *after* high school. Questions pertained to the application process, admissions, financial aid offers, institutions attended, experiences at these institutions, and educational expectations. Complete month-by-month enrollment histories for all postsecondary institutions attended after high school were collected in this section. These enrollment histories (in conjunction with the date of high school completion or exit, as preloaded or reported in the *High School* section of the interview) were used to classify respondents into one of six mutually exclusive categories: standard enrollees, delayers, leavers, delayer-leavers, nonenrollees, and high school students. The questions administered to each respondent depended on his/her category. These categories were used for the *Employment* and *Community* sections as well. For more details, see the *Education Longitudinal Study of 2002: Base-Year to Second Follow-up Data File Documentation* (Ingels et al. 2007).

There were five topics in the *Employment* section. The questions for the first topic referred to the first job after high school. The second set of questions focused on employment at the time of the interview. The next set focused on jobs held by postsecondary students during the 2004–05 and 2005–06 academic years. Respondents were also questioned about months of unemployment (if a gap existed between high school and their first job, their first job and their current job, and/or their first job and the date of the interview, if they were not currently working). Lastly, the questions for the fifth topic focused on income, finances, and occupational expectations at age 30.

The final substantive section of the interview, *Community*, covered topics related to family formation, living arrangements, community involvement (including military service), and experiences that may influence the life course. With one minor exception, all questions pertained to all respondent types.

The interview concluded with the *Locating* section, which collected information that will be used to contact the respondents in the next round of the study.

High school transcript study. Transcripts were collected from sample members in late 2004 and early 2005, about 6 months to 1 year after most students had graduated from high school. Transcripts were collected from the students' base-year school. However, if it was learned during the first follow-up data collection that they had transferred, transcripts were collected from two schools: the base-year school and the last known school of attendance. For students who were added to the study during their senior year (known as "freshened" students), transcripts were only collected from their senior-year school. Transcripts were collected for regular graduates, as well as dropouts, early graduates, and students who were homeschooled after their sophomore year. For more information, see the High School Transcript (HST) Studies chapter.

The ELS:2002 high school transcript data collection sought key pieces of information about coursetaking from students' official high school records (e.g., courses taken while attending secondary school, credits earned, year and term a specific course was taken, and final grades). When available, other information, such as dates enrolled, reason for leaving school, and standardized test scores, was collected. All information was transcribed and can be linked back to the students' questionnaire or assessment data. Because of the size and complexity of the file and the reporting variation by school, additional variables were constructed from the raw transcript file to facilitate analyses. These variables include standardized grade point averages (GPAs), academic pipeline measures, and total credits earned by subject area. The construction of many of the transcript variables is based on Carnegie units. A Carnegie unit is equal to a course taken every day, one period per day, for a full school year.

Third follow-up survey. The third follow-up (2012) questionnaire was designed for electronic self-administration (web) or computer-assisted interviewer administration (computer-assisted telephone interview–CATI or computer-assisted personal interview–CAPI). Items were selected primarily for their intracohort value, that is, their relevance, as final outcomes, to the antecedent or predictor variables gathered in earlier rounds. Of secondary importance was the intercohort value of items, that is, whenever possible variables were used which

would prove comparable to those employed in the final round of NELS:88 in 2000, when the NELS:88 cohort was approximately the same age (and years beyond high school) as the third follow-up ELS:2002 sample.

For the third follow-up, there is only one strictly comparable point in time with which to link on a cross-cohort basis, the NELS:88 fourth follow-up in 2000. Below, content of the third follow-up questionnaire is summarized, followed by a summary of the abbreviated version of the instrument.

Current status. The interview asks about the respondent's current activities, such as labor market status and educational status.

High school completion. For sample members who had not completed high school (or General Educational Development [GED]) by the second follow-up or whose completion status was unknown, the third follow-up interview obtained updated information.

Postsecondary education. This section of the interview focused on the postsecondary enrollment and attainment at all levels of credentialing and degree completion and includes all forms and levels of sub-baccalaureate, baccalaureate, and graduate and professional enrollment. It also gathers information such as primary or secondary major or program of study. First, sample members were asked to identify postsecondary institutions they had attended; second, they were asked to identify any postsecondary credentials earned. Attendance information were used to conduct the postsecondary education transcript component of the study in 2013–14. Reasons for leaving school were also elicited.

The college experience. Although most sample members were, by 2012, out of school, it was still possible to ask some questions retrospectively, about the college experience, and its perceived role and impact as carried into the mid-twenties of the cohort.

Education finance. The questionnaire explores the issue of educational borrowing and its impact. Information about receipt of scholarships, fellowships, and grants is also obtained.

Educational expectations. Following in the tradition of the prior NCES high school cohort studies, all respondents were asked to report the highest level of education they expected to achieve by age 30 (average age at time of interview is about 26).

Employment and income. The interview gathered information on employment and income. A brief employment history is collected. Respondents were asked to answer a series of questions about job title and duties,

hours worked, earnings, and employer type. Both the employed and the unemployed were asked about perceived employment barriers they may have faced or be facing. All respondents were asked for their annual income and whether they have any dependents. These questions will allow analysts to roughly estimate net earnings after taxes. The questionnaire asked separately about employment through the military. In addition, some scales have been added on job orientation and satisfaction, that are informed by social-cognitive career theory, and that were written specially for ELS:2002.

Family formation. The interview collected information about family life and civic engagement (including both voting and community service). With respect to family, the questions determine marital status, whether the respondent has children, and members of the household.

Life values. As included in earlier rounds of ELS:2002 as well as in some of the prior NCES secondary longitudinal studies, questions are asked about the life values (acquisition of money, friendships, helping others, a good marriage, etc.) that are important to the respondent.

Additional topics. Additional topics included civic engagement, assets/debt, and certification/licensure.

Postsecondary transcript study. Transcripts were collected from sample members in 2012, during the third follow-up collection phase. Transcripts were requested from all postsecondary institutions that the sample members attended, including any copies of transcripts institutions had received from any transfer schools attended.

The ELS:2002 postsecondary transcript data collection sought key pieces of information regarding types of degree programs, periods of enrollment, majors or fields of study for instructional programs, specific courses taken, grades and credits attained, and credentials earned. Transcript information was coded using the Keying and Coding System (KCS). For more details, see the Postsecondary Transcript Studies (PETS) chapter.

Periodicity

The base-year survey was conducted in the spring of 2002. The first follow-up was done in 2004, as was the high school transcript component. A post-high school follow-up was done in 2006. In the third follow-up, sample members were interviewed between July 2012 and February 2013 to collect the study's final outcomes (e.g., persistence in higher education, sub-baccalaureate and baccalaureate attainment, transition into the labor market). Postsecondary transcripts were also collected as part of the third follow-up.

Data Availability

Data are available for all waves of ELS:2002 at https://nces.ed.gov/surveys/els2002/avail_data.asp.

2. USES OF DATA

Using the multilevel and longitudinal information from the base year (2002) and first follow-up (2004) of ELS:2002 will help researchers and policymakers explore and better understand such issues as the importance of home background and parental aspirations for a child's success; the influence of different curriculum paths and special programs; the effectiveness of different high schools; and whether a school's effectiveness varies with its size, organization, climate or ethos, curriculum, academic press, or other characteristics. These data will facilitate an understanding of the impact of various instructional methods and curriculum content and exposure in bringing about educational growth and achievement.

After the high school years, ELS:2002 will continue to follow its sample of students into postsecondary education and/or the labor market. For students who continue on to higher education, data collected from the second follow-up and the third follow-up will help researchers measure the effects of these students' high school careers on subsequent access to postsecondary institutions; their choices of institutions and programs; and, as time goes on, their postsecondary persistence, attainment, and eventual entry into the labor force and adult roles. For students who go directly into the workforce (whether as dropouts or high school graduates), ELS:2002 will be able to determine how well high schools have prepared these students for the labor market and how they fare within it.

Apart from helping to describe the status of high school students and their schools, the second and third follow-up data will provide information to help address a number of key policy and research questions. The study is intended to produce a comprehensive dataset for the development and evaluation of education policy at all government levels. Part of its aim is to inform decision-makers, educational practitioners, and parents about the changes in the operation of the education system over time and the effects of various elements of the system on the lives of the individuals who pass through it. Issues that can be addressed with data collected in the high school years include the following:

- students' academic growth in mathematics;
- the process of dropping out of high school—determinants and consequences;
- the role of family background and the home education support system in fostering students' educational success;

- the features of effective schools;
- the impact of coursetaking choices on success in the high school years (and thereafter);
- the equitable distribution of educational opportunities as registered in the distinctive school experiences and performance of students from various subgroups; and
- steps taken to facilitate the transition from high school to postsecondary education or the world of work.

After ELS: 2002 students have completed high school, a new set of issues can be examined using data from the second and third follow-ups. These issues include

- the later educational and labor market activities of high school dropouts;
- the transition of students who do not go directly on to postsecondary education or the world of work;
- access to, and choice of, undergraduate and graduate education institutions;
- persistence in attaining postsecondary educational goals;
- rate of progress through the postsecondary curriculum;
- degree attainment;
- barriers to persistence and attainment;
- entry of new postsecondary graduates into the workforce;
- social and economic rate of return on education to both the individual and society; and
- adult roles, such as family formation and civic participation.

3. KEY CONCEPTS

Cognitive Test Battery

The test questions were selected from previous assessments: NELS:88, the National Assessment of Educational Progress (see NAEP chapter), and Program for International Student Assessment (see PISA chapter). Most, but not all, were multiple choice items. Test specifications for ELS:2002 were adapted from frameworks used for NELS:88. Math tests contained items in arithmetic, algebra, geometry, data/probability, and advanced topics were divided into process categories of skill/knowledge, understanding/ comprehension, and problem solving. Through inclusion of items from the PISA, the ELS:2002 math tests placed a somewhat greater

emphasis on practical applications and problem solving than did the NELS:88 test forms. Reading tests consisted of reading passages of one paragraph to one page in length, followed by three to six questions based on each passage. The reading passages included literary material as well as topics in the natural and social sciences. Several passages required interpretation of graphs. Questions were categorized as reproduction of detail, comprehension, or inference/evaluation.

Cohort

A cohort is a group of individuals who have a statistical factor in common; for example, year of birth, grade in school, or year of high school graduation. ELS:2002 is a sophomore-grade cohort based on the spring term of the 2001–02 school year. It also contains, however, a nationally representative sample of high school seniors in the spring term of the 2003–04 school year.

Socioeconomic Status (SES)

A composite variable is constructed through the combination of two or more variables—socioeconomic status, for example, combines mother’s education, father’s education, mother’s occupation, father’s occupation, and family income or an income proxy (household items) or it is calculated through the application of a mathematical function or transformation to a variable (e.g., conversion of raw test scores to percentile ranks).

Dropout

Dropouts were defined in ELS:2002 as sample members who had been absent from school for 4 or more consecutive weeks at the time of the survey and who were not absent due to accident or illness.

Early Graduate

Early graduates were defined as sample members who had graduated from high school or obtained certification of high school equivalency (e.g., obtained a GED credential) on or before March 15, 2004.

4. SURVEY DESIGN

Target Population

The ELS:2002 base year comprises two primary target populations—schools with 10th grades and 10th-grade students—in the spring term of the 2001–02 school year. There are two slightly different target populations for the first follow-up. One population consists of those students who were enrolled in the 10th grade in 2002. The other population consists of those students who were enrolled in the 12th grade in 2004. The former population includes students who dropped out of school between 10th and 12th grades, and such students are a major analytical subgroup. The target populations of the ELS:2002 second follow-up (2006) were the 2002 sophomore cohort and the 2004

senior cohort. The sophomore cohort consists of those students who were enrolled in the 10th grade in the spring of 2002 and the 12th-grade cohort comprises those students who were enrolled in the 12th grade in the spring of 2004. The sophomore cohort includes students who were in the 10th grade in 2002 but not in the 12th grade in 2004 (i.e., sophomore cohort members but not senior cohort members). The senior cohort includes students who were 12th-graders in 2004 but were not in the 10th grade in U.S. schools in 2002; they were included through a sample freshening process as part of the first follow-up activities. No additional sampling was performed for the third follow-up. The target populations for the third follow-up are the same as those in the first and second follow-ups; namely, those students who were enrolled in the 10th grade in 2002 and those students who were enrolled in the 12th grade in 2004.

Sample Design

The sample design for ELS:2002 is similar in many respects to the designs used in the three prior studies of the National Center for Education Statistics (NCES) Longitudinal Studies Program: the National Longitudinal Study of the High School Class of 1972 (NLS:72), HS&B, and NELS:88. ELS:2002 is different from NELS:88 in that the ELS:2002 base-year sample students are 10th-graders rather than 8th-graders. As in NELS:88, there were oversamples of Hispanics and Asians in ELS:2002. However, for ELS:2002, counts of Hispanics and Asians were obtained from the Common Core of Data (CCD) and the Private School Universe Survey (PSS) to set the initial oversampling rates.

ELS:2002 used a two-stage sample selection process. First, schools were selected with probability proportional to size, and school contacting resulted in 1,220 eligible public, Catholic, and other private schools from a population of approximately 27,000 schools containing 10th-grade students. Of the eligible schools, 752 participated in the study. These schools were then asked to provide 10th-grade enrollment lists. In the second stage of sample selection, approximately 26 students per school were selected from these lists.

Base-year survey. The ELS:2002 base-year sample design comprises two primary target populations—schools with 10th grades and sophomores in these schools—in the spring term of the 2001–02 school year. The base-year survey used a two-stage sample selection process. First, schools were selected. These schools were then asked to provide sophomore enrollment lists.

The target population of schools for the ELS:2002 base year consisted of regular public schools, including state Department of Education schools and charter schools, and Catholic and other private schools that contained 10th

grades and were in the United States (the 50 states and the District of Columbia). The sampling frame of schools was constructed with the intent to match the target population. However, selected schools were determined to be ineligible if they did not meet the definition of the target population. Responding schools were those schools that had a survey day (i.e., a day when data collection occurred for students in the school). Of the 1,270 sampled schools, there were 1,220 eligible schools and 752 responding schools (67.8 percent weighted response rate). School-level data reflect a school administrator questionnaire, a library media center questionnaire, a facilities checklist, and the aggregation of student data to the school level. School-level data, however, can also be reported at the student level and serve as contextual data for students.

The target population of students for the full-scale ELS:2002 consisted of spring-term sophomores in 2002 (excluding foreign exchange students) enrolled in schools in the school target population. The sampling frames of students within schools were constructed with the intent to match the target population. However, selected students were determined to be ineligible if they did not meet the definition of the target population. Of the 19,220 sampled students, there were 17,590 eligible students and 15,360 participants (87.3 percent weighted response rate). Student-level data consist of student questionnaire and assessment data and reports from students' teachers and parents.

First follow-up survey. The basis for the sampling frame for the first follow-up was the sample of schools and students used in the ELS:2002 base-year sample. There are two slightly different target populations for the follow-up. One population consists of those students who were enrolled in the 10th grade in 2002. The other population consists of those students who were enrolled in the 12th grade in 2004. The former population includes students who dropped out of school between 10th and 12th grades, and such students are a major analytical subgroup. Note that in the first follow-up, a student who is defined as a member of the student sample is either an ELS:2002 spring 2002 sophomore or a freshened first follow-up spring 2004 12th-grader.

If a base-year school split into two or more schools, many of the ELS base-year sample members moved en masse to a new school, and they were followed to the destination school. These schools can be thought of as additional base-year schools in a new form. Specifically, a necessary condition of adding a new school in the first follow-up was that it arose from a situation such as the splitting of an original base-year school, thus resulting in a large transfer of base-year sample members (usually to one school, but potentially to more). Four base-year schools split, and five new schools were spawned from these four schools. At

these new schools, as well as at the original base-year schools, students were tested and interviewed. Additionally, student freshening was done, and the administrator questionnaire was administered.

Second follow-up survey. The target populations of the ELS:2002 second follow-up (2006) were the 2002 sophomore cohort and the 2004 senior cohort. The 2002 sophomore cohort consists of those students who were enrolled in the 10th grade in the spring of 2002, and the 2004 senior cohort comprises those students who were enrolled in the 12th grade in the spring of 2004. The sophomore cohort includes students enrolled in the 10th grade in 2002, but not in the 12th grade in 2004 (i.e., sophomore cohort members, but not senior cohort members). The senior cohort includes students enrolled in the 12th grade in 2004, but not in the 10th grade in 2002; they were included through a sample freshening process as part of the first follow-up activities.

The second follow-up fielded sample consisted of 16,430 sample members: 14,100 respondents for both the base year and the first follow-up; 1,200 first follow-up nonrespondents who were base-year respondents; 650 base-year nonrespondents who were subsampled in the first follow-up and responded in the first follow-up; 210 base-year or first follow-up questionnaire-incapable members; 170 freshened respondents in the first follow-up; and 100 base-year respondents who were determined to be out of scope in the first follow-up. Once fielded, some members of the sample of 16,430 were determined to be out of scope. There were 460 out-of-scope second follow-up sample members who fell into five basic groups: deceased, out of country, institutionalized/incarcerated, questionnaire incapable/incapacitated, or unavailable for the duration of the 2006 data collection.

High school transcript study. Transcripts were collected for all sample members who participated in at least one of the first two student interviews: the base-year interview or the first follow-up interview. These sample members include base-year respondents who were first follow-up nonrespondents and base-year nonrespondents who were first follow-up respondents. Thus, sample members who were dropouts, freshened sample members, transfer students, homeschooled students, and early graduates are included if they were respondents in either of the first two student interviews. Transcripts were also requested for students who could not participate in either of the interviews because of a physical disability, a mental disability, or a language barrier.

Unlike previous NCES transcript studies, which collected transcripts only from the last school attended by sample members, the ELS:2002 transcript study collected transcripts from all base-year schools and the last school

attended by sample members who transferred out of their base-year school. Incomplete records were obtained for sample members who had dropped out of school, had fallen behind the modal progression sequence, or were enrolled in a special education program requiring or allowing more than 12 years of schooling. Eighty-six percent of transcript respondents have 4 complete years of high school transcript information.

Third follow-up survey. No additional sampling was performed for the third follow-up. The target populations for the third follow-up are the same as those in the first and second follow-ups; namely, those students who were enrolled in the 10th grade in 2002 and those students who were enrolled in the 12th grade in 2004. Eligible sample members who had not responded in the second follow-up and in the first follow-up were not fielded for the third follow-up. A total of 16,176 sample members were fielded for the third follow-up.

Postsecondary transcript study. The basis for the ELS:2002 postsecondary transcript data collection is the same as the basis for the third follow-up, although the target population for the postsecondary transcript data collection corresponds to a specific subpopulation of the two overarching ELS student populations; namely, the students in the 10th grade in 2002 or the 12th grade in 2004 who had attended one or more postsecondary institutions since 2002 and who were alive as of the third follow-up.

During the second and third follow-up surveys, respondents were asked to provide the name and location of each postsecondary institution that they had attended. Those institutions were subsequently contacted in 2013–14, and postsecondary transcripts were requested for each ELS:2002 sample member who reported attendance. The ELS:2002 postsecondary transcript data include 11,522 members of the sophomore cohort for whom at least one postsecondary transcript was collected. Overall, transcripts were obtained for 11,623 of 12,549 eligible sample members for a weighted response rate of 77 percent.

Data Collection and Processing

The base-year survey collected data from students, parents, teachers, librarians, and school administrators. Self-administered questionnaires and cognitive tests were the principal modes of data collection. Data collection took place primarily during in-school survey sessions conducted by Research Triangle Institute (RTI) field interviewer or team. Base-year data were collected in the spring term of the 2002 school year. A total of 752 high schools participated, resulting in a weighted school response rate of 67.8 percent. A total of 15,360 students participated, primarily in in-school sessions, for an 87.3 percent weighted response rate. Each sampled student's

mathematics teacher and English teacher were given a questionnaire to complete. Weighted student-level coverage rates for teacher data were 91.6 percent (indicating receipt of a report from the math teacher, the English teacher, or both). School administrators and library media coordinators also completed a questionnaire (the weighted response rates were 98.5 percent and 95.9 percent, respectively). Questionnaires were mailed to parents, with a telephone follow-up for nonresponders.

Student coverage for parent questionnaires was 87.5 percent (weighted). Survey administrators (SAs) completed a facilities checklist at each school. For the first follow-up, overall, about 89 percent (weighted) of the total ELS:2002 sample (comprising both 2002 sophomores 2 years later and 2004 freshmen seniors) was successfully surveyed—whether through completion of a student, transfer student, dropout, homeschool, or early graduate questionnaire. For the second follow-up, the sample represents a subset of the combined population of 10th-graders in the spring term of 2002 and 12th-graders in the spring term of 2004. Of the total sample, approximately 15,900 were considered to be eligible for the 2006 data collection, among which 14,200 participated, resulting in an 88.4 percent weighted response rate. For the third follow-up, a weighted student response rate of 78 percent was achieved. For the postsecondary transcript study, a weighted response rate of 77 percent was achieved.

Reference dates. In the base-year survey, most questions referred to the students' experience up to the time of the survey's administration in spring 2002. In the follow-ups, most questions referred to experiences that occurred between the previous survey and the current survey. For example, the first follow-up largely covered the period between 2002 (when the base-year survey was conducted) and 2004 (when the first follow-up was conducted).

Data collection. The base-year student data collection began in schools on January 21, 2002, and ended in schools in June 2002; telephone interviews with nonresponding students ended on August 4, 2002. Data collection from school administrators, library media center coordinators, and teachers ended in September 2002. The parent data collection ended on October 17, 2002. The first follow-up in-school data collection occurred between January and June 2004; out-of-school data collection took place between February and August 2004 and included telephone and in-person interviews. The second follow-up data collection was conducted from January to September 2006. To notify sample members about the start of data collection, all sample members and parent(s) were sent a packet which included instructions for the web-based survey. The third follow-up data collection began July 2012 and continued through February 2013. The

postsecondary transcript data collection began in March 2013 and continued through early April 2014.

During the field test of the base-year study, endorsements were secured from organizations felt to be influential in the eyes of the various entities being asked to participate (school administrators, librarians, teachers, students, and parents). Before school recruitment could begin, it was necessary to obtain permission to contact the schools. The Chief State School Officers (CSSOs) of each state (as well as the District of Columbia) were contacted to approve the study for the state. Permission to proceed to the district level was obtained in all 50 states as well as the District of Columbia. Once state approval was obtained, an information package was sent to the District Superintendent of each district/diocese that had sampled schools in the state. Permission to proceed to the school level was received from 693 of the 829 districts/dioceses having eligible sampled schools (83.6 percent). This represented a total of 891 eligible schools with district/diocese permission to be contacted among 1,060 eligible schools affiliated with districts/dioceses (84.1 percent). For public and Catholic schools, school-level contact was begun as soon as district/diocese approval was obtained. For private non-Catholic schools, it was not necessary to wait for higher approval, though endorsements from various private school organizations were sought. The principal of each cooperating school designated a school coordinator to serve as a point of contact at the school and to be responsible for handling the logistical arrangements. The coordinator was asked to provide an enrollment list of 10th-grade students. For each student, the coordinator was asked to give information about sex, race, and ethnicity, and whether the student had an Individualized Education Program (IEP). Dates for a survey day and two make-up days were scheduled. At the same time, staff members were designated to receive the school administrator and library media center questionnaires. Parental consents were obtained. On the survey day at each school, the survey administrator (SA) checked in with the school coordinator and collected any parental permission forms that had come in.

For the base-year and first follow-up surveys, the SA and survey administrator assistant (SAA) administered the student questionnaire and tests via a group administration. The SA and SAA graded the routing tests (see details in the section of "Cognitive test data") and edited the student questionnaires for completeness. Makeup sessions were scheduled for students who were unable to attend the first session. Interviews were conducted by CATI for students who were unable to participate in the group-administered sessions. The school administrator, teacher, library media center, and parent questionnaires were self-administered; individuals who did not return their questionnaires by mail within a reasonable amount of time were followed up by

telephone. The facilities checklist was completed by the SA based on his/her observations in the building on the school's survey day.

The first follow-up data collection required intensive tracing efforts to locate base-year sample members who, by 2004, were no longer in their 10th-grade schools, but had dispersed to many high schools. In the spring and again in the autumn of 2003, each base-year school was provided a list of ELS:2002 base-year sample members from their school. The school was asked to indicate whether each sample member was still enrolled at the school. For any sample member who was no longer enrolled, the school was asked to indicate the reason and date the student left. If the student had transferred to another school, the base-year school was asked to indicate the name and location of the transfer school. In the fall of 2003, each base-year school was also asked to provide a list of the 12th-graders enrolled at that school, so this information could be used in the freshening process. For students who had left their base-year school, the school was asked to provide contact information to allow for out-of-school data collection during the first follow-up survey period. Telephone data collection began in February 2004. Sample members identified for initial contact by the telephone unit included those no longer enrolled at the base-year school and those who attended base-year schools that did not grant permission to conduct an in-school survey session. Other cases were identified for telephone follow-up after the survey day and all makeup days had taken place at the school that the sample members attended. Some nonresponding sample members were assigned to SAs for field follow-up. A total of 797 sample members were interviewed in the field. An additional 80 field cases were completed either by mailed questionnaire or telephone interview and were withdrawn from the field assignment.

Data collection for the second follow-up was significantly redesigned to include survey modes and procedures that were completely independent of the in-school orientation of the first follow-up survey. An important aspect of the second follow-up data collection was that high schools were no longer involved in providing assistance with locating sample members. Tracing and sampling maintenance techniques included the following: batch tracing services for updated address information and telephone numbers; updated locating information obtained from student federal financial aid applications; direct contact with sample members and their parents via mail, telephone, or the Internet; intensive tracing efforts by centralized tracing specialists; intensive tracing efforts by field locating specialists in local areas; and tracing students through postsecondary schools applied to or attended, as specified in the 2004 interview. Also, incentive payments

were offered to respondents to maximize their participation.

There were three survey modes in the second follow-up: a web-enabled self-administered questionnaire, CATI, and CAPI. Data collection for the second follow-up began on January 25, 2006. For the first 4 weeks, only web and call-in data collection was made available to sample members. After the initial 4 weeks, outbound CATI data collection efforts were undertaken. The primary purpose of the CATI data collection was to complete telephone interviews with sample members when contacted or to set up an appointment to complete the interview. The CATI instrument was virtually identical to the web self-interview. (The only difference was that the CATI version provided an interviewer instruction on each screen to facilitate administration of each item.) CATI interviewers adhered to standardized interviewing techniques and other best practices in administering the interview. To reach sample members who had not yet participated by web or CATI modes, CAPI data collection commenced on April 17 (8 weeks after the start of outbound CATI calling). The approach for CAPI data collection followed the strategy used successfully in B&B:93/2003 and other recent NCES studies. This approach first identified geographic clusters according to the last known zip codes of sample members who could potentially be assigned to CAPI interviewing. Then, based on the distribution of cases by cluster, those that had the highest concentration of cases were staffed with one or more field interviewers. CAPI interviews were conducted on laptop computers via a web-based interface that used personal web server software. To maintain consistency across interviewing modes, the CAPI interview was identical to the CATI interview. CAPI interviewers were allowed to administer the interview over the telephone, which produced conditions even more similar to CATI interviewing.

Several locating methods were used to find and collect up-to-date contact information for the ELS:2002 third follow-up sample. Batch searches of national databases and address update mailings to sample members and a parent were conducted prior to the start of data collection. Follow-up locating methods were employed for those sample members not found after the start of data collection, including computer-assisted telephone interview (CATI) locating, computer-assisted personal interview (CAPI) field tracing, and intensive tracing. Initial mailings began on July 3, 2012 with CATI production beginning on August 5, and nonrespondent abbreviated interviews offered beginning on January 7, 2013.

Sample members were provided with a link to the ELS:2002 third follow-up website prior to the start of data collection. The website provided general information about

the study, including the study sponsor and contractor, how the data are used, answers to frequently asked questions (FAQs), confidentiality assurances, and selected findings from earlier rounds of ELS:2002. The website also provided contact information for the study help desk and project staff at RTI, as well as a link to the NCES website. Sample members were able to log in to the secure website to provide updated contact information and complete the sample member interview once it became available. Designed according to NCES web policies, the study website used a three-tier security approach to protect all data collected. The first tier of security included secure logins, with a unique study ID and strong password provided to sample members. The second tier of security protected any data entered on the website with secure socket layer technology, allowing only encrypted data to be transmitted over the Internet. The third tier of security stored any collected data in a secured SQL Server database located on a server machine that was physically separate from the web server. Sample members were also provided with a toll-free telephone number, which was answered by help desk agents. Help desk staff were available to sample members who had questions or technical issues related to completion of the web interview.

Data processing. Data processing activities were quite similar for the base-year survey and the first follow-up. An initial check of student documents for missing data was performed on-site by the SA and SAA staff so that data could be retrieved from the students before they left the classroom. If a student neglected to answer a questionnaire item deemed to be critical, the SA/SAA asked the student to complete it after the end of the second-stage test (see details in the section of “Cognitive test data”).

All TELEform questionnaire scans were stored in a Structured Query Language (SQL) server database. CATI data were exported nightly to ASCII files. Cleaning programs were designed to concatenate CATI and TELEform SQL server data into SAS datasets, adjusting and cleaning variables when formats were not consistent. Special attention was focused on this concatenation to verify that results stayed consistent and to rule out possible format problems. Once questionnaire data were concatenated and cleaned across modes and versions, the following cleaning and editing steps were implemented:

- anomalous data cleaning based on a review of the data with the original questionnaire image;
- rule-based cleaning (changes that were made based on patterns in the data rather than on a review of the images);
- hard-coded edits based on changes recommended by a reviewer, if a respondent misunderstood the

questionnaire (e.g., respondent was instructed to enter a percentage, but there was strong evidence that the respondent entered a count rather than a percentage); and

- edits based on logical patterns in the questionnaire (e.g., skip pattern relationships between gate and dependent questions).

All respondent records in the final dataset were verified with the Survey Control System (SCS) to spot inconsistencies. Furthermore, the data files served as a check against the SCS to ensure that all respondent information was included in production reports.

Data processing activities for the second follow-up differed from those in the base-year survey and the first follow-up, because respondents could complete a self-administered web questionnaire as an alternative to the survey modes used in previous years. A database was developed in which case/item-specific issues were reviewed and new values were recorded for subsequent data cleaning and editing.

Many of the systems and processes used in the ELS:2002 third follow-up were designed during the first follow-up field test with improvements implemented for the main study and later for the second follow-up. The following systems were developed and used for the first follow-up and employed and improved thereafter: Integrated Management System (IMS)—a comprehensive tool used to exchange files between RTI and the National Center for Education Statistics (NCES), post daily production reports, and provide access to a centralized repository of project data and documents; Survey Control System (SCS)—the central repository of the status of each activity for each case in the study; Hatteras Survey Engine and Survey Editor—a web-based application used to develop and administer the ELS:2002 instrument; Computer-assisted telephone interview (CATI) Case Management System (CMS)—a call scheduler and case delivery tracking system for telephone interviews; Integrated Field Management System (IFMS)—a field reporting system to help field supervisors track the status of in-school data collection and field interviewing; ELS:2002 survey website—public website hosted at NCES and used to disseminate information, collect sample data, and administer the survey; and Data-cleaning programs—SAS programs developed to apply reserve code values where data are missing, clean up inconsistencies (because of respondents backing up), and fill data where answers are known from previously answered items.

Editing. An application was developed in which case/item-specific issues were reviewed and new values were recorded for subsequent data cleaning and editing. Records were selected for review based on one of the following

criteria: random selection, suspicious values found during frequency reviews, values out of expected ranges, interviewer remarks, and values not adhering to a particular skip pattern. The review application provided the case/item-level information, the reason for the review, and a link to the scanned image of the questionnaire. Reviewers determined scanning corrections, recommended changes (if respondents had misinterpreted the question), and reviewed items randomly to spot potential problems that would require more widespread review.

The application was built on an SQL server database that contained all records for review and stored the recommended data changes. Editing programs built in SAS read the SQL server database to obtain the edits and applied the edits to the questionnaire data. Questionnaire data were stored at multiple stages across cleaning and editing programs, so comparison across each stage of data cleaning could be easily confirmed with the recommended edits. Raw data were never directly updated, so changes were always stored cumulatively and applied each time a cleaned dataset was produced. This process provided the ability to document all changes and easily fix errors or reverse decisions upon further review.

Editing programs also contained procedures that output inconsistent items across logical patterns within the questionnaire. For example, instructions to skip items could be based on previously answered questions; however, the respondent may not have followed the proper pattern based on the previous answers. These items were reviewed, and rules were written either to correct previously answered (or unanswered) questions to match the dependent items or blank out subsequent items to stay consistent with previously answered items.

Variables drawn directly from third follow-up questionnaire items were edited in three ways: (1) they were edited via the application of reserve codes; (2) they were edited by carrying forward known information from previously administered items/variables to downstream items/variables which were legitimately skipped during survey administration; and (3) they were edited to address inconsistent responses.

Estimation Methods

The general purpose of the weighting scheme was to compensate for unequal probabilities of selection of students into the base-year sample and freshened students into the first follow-up sample and to adjust for the fact that not all students selected into the sample actually participated.

Weighting.

Student level. Two sets of student weights were computed. There is one set of weights for student questionnaire completion; this is the sole student weight that appears in

the public-use file and generalizes to the population of spring 2002 sophomores who were capable of completing an ELS:2002 student questionnaire. A second set of weights, for the expanded sample of questionnaire-eligible and questionnaire-ineligible students, appears only in the restricted-use file. This weight sums to the total of all 10th-grade students.

First, the student-level design weight was calculated. The sample students were systematically selected from the enrollment lists at school-specific rates that were inversely proportional to the school's probability of selection. Specifically, the sampling rate for the student stratum within a school was calculated as the overall sampling rate divided by the school's probability of selection. To maintain control of the sample size and to accommodate in-school data collection, the sampling rates were adjusted, when necessary, so that no more than 35 students were selected. A minimum sample size constraint of 10 students was also imposed, if a school had more than 10 tenth-graders. Adjustments to the sampling rates were also made, as sampling progressed, to increase the sample size in certain student strata that were falling short of the sample size targets. The student sampling weight then was calculated as the reciprocal of the school-specific student sampling rate. The student nonresponse adjustment was performed using Generalized Exponential Models (GEMs) to compute the two student nonresponse adjustment factors. For data known for most, but not all, students, the data collected from responding students and weighted hot-deck imputation were used so that there would be data for all eligible sample students.

An additional eight student weights were computed for ELS: 2002 PETS to incorporate data from both the 10th- and 12th-grade student populations, as the PETS sample contains students from both cohorts.

School level. School weights were computed in several steps. First, a school-level design weight equal to the reciprocal of the school's probability of selection was calculated; second, the school's design weight was adjusted to account for field-test sampling; third, the school weight was adjusted to account for the probability of the school being released. Next, GEMs, which are a unified approach to nonresponse adjustment, poststratification, and extreme weight reduction, were used. For data known for most, but not all, schools that would be useful to include in the nonresponse adjustment, weighted hot-deck imputation was used so that there would be data for all eligible sample schools.

Six sets of weights were computed for the third follow-up. Although third follow-up *student* weights were created, no third follow-up *school* weights were created.

Scaling. Item Response Theory (IRT) was used to calibrate item parameters for all cognitive items administered to all students. This makes it possible to obtain scores on the same scale for students who took harder or easier forms of the test. IRT also permits vertical scaling of the two grade levels (10th grade in 2002 and 12th grade in 2004). A scale score estimating achievement level was assigned based on the pattern of right, wrong, and omitted responses on all items administered to an individual student. IRT postulates that the probability of correct responses to a set of test questions is a function of true proficiency and of one or more parameters specific to each test question. Rather than merely counting right and wrong responses, the IRT procedure also considers characteristics of each of the test items, such as their difficulty and the likelihood that they could be guessed correctly by low-ability individuals. IRT scores are less likely than simple number-right or formula scores to be distorted by correct guesses on difficult items if a student's response vector also contains incorrect answers to easier questions.

Imputation. In the base-year study, after the editing process (which included logical imputations), the remaining missing values for 14 analysis variables and two ability estimates (reading and mathematics) were statistically imputed. In the first follow-up study, two new variables were selected for imputation: the spring 2004 student ability estimate for mathematics and the spring 2004 student enrollment status. These variables were chosen because they are key variables used in standard reporting and cross-sectional estimation. Most of the variables were imputed using a weighted hot-deck procedure. Additionally, multiple imputations were used for a few variables, including test scores. A set of 14 key analytic variables was identified for item imputation on data obtained from the ELS:2002 third follow-up member interview. These 14 variables include indicators of whether the respondent ever applied to or attended a postsecondary institution, highest level of education attained, and various employment indicators such as whether the respondent has held a job for pay since high school, as well as total job earnings. A weighted sequential hot-deck (WSHD) imputation procedure was used to impute the missing values for the ELS:2002 third follow-up data.

5. DATA QUALITY AND COMPARABILITY

Sampling Error

The variance estimation procedure had to take into account the complex sample design, including stratification and clustering. One common procedure for estimating variances of survey statistics is the Taylor series linearization procedure. This procedure takes the first-order Taylor series approximation of the nonlinear statistic

and then substitutes the linear representation into the appropriate variance formula based on the sample design. For stratified multistage surveys, the Taylor series procedure requires analysis strata and analysis primary sampling units (PSUs). Therefore, analysis strata and analysis PSUs were created. The impact of the departure of the ELS:2002 complex sample design from a simple random sample design on the precision of sample estimates can be measured by the design effect.

Design effects. The ELS:2002 sample departs from the assumption of simple random sampling in three major respects: student samples were stratified by student characteristics, students were selected with unequal probabilities of selection, and the sample of students was clustered by school. A simple random sample is, by contrast, unclustered and not stratified. Additionally, in a simple random sample, all members of the population have the same probability of selection. Generally, clustering and unequal probabilities of selection increase the variance of sample estimates relative to a simple random sample, and stratification decreases the variance of estimates.

In the ELS:2002 base-year study, standard errors and design effects were computed at the first stage (school level) and at the second stage (student level). The school administrator questionnaire was the basis for the school-level calculations; however, two items from the library questionnaire were also included. For student-level calculations, items from both the student and parent questionnaires were used. Therefore, three sets of standard errors and design effects were computed (school, student, and parent), which is similar to what was done for NELS:88. Each of the three sets includes standard errors and design effects for 30 means and proportions overall and for subgroups.

The student-level base-year design effects indicate that the ELS:2002 base-year sample was more efficient than the NELS:88 sample and the HS&B sample. For means and proportions based on student questionnaire data for all students, the average design effect in ELS:2002 was 2.35; the comparable figures were 3.86 for NELS:88 sophomores and 2.88 for the HS&B sophomore cohort. For all subgroups, the ELS:2002 design effects are smaller, on average, than those for the HS&B sophomore cohort. The smaller design effects in ELS:2002 compared to those for NELS:88 sophomores are probably due to disproportional strata representation introduced by subsampling in the NELS:88 first follow-up. The smaller design effects in ELS:2002 compared to those for the HS&B sophomore cohort may reflect the somewhat smaller cluster size used in the later survey. The ELS:2002 parent-level design effects are similar to the student-level design effects. For estimates applying to all students, the average design effect was 2.24 for the parent data and 2.35

for the student data. For almost all subgroups, the average design effect was lower for the parent data than for the student data. The school-level design effects reflect only the impact of stratification and unequal probabilities of selection because the sample of schools was not clustered. Therefore, it could be expected that the design effects for estimates based on school data would be small compared to those for estimates based on student and parent data. However, this is not the case, as the school average design effect is 2.76. The reason for this is that the sample was designed to estimate students with low design effects. In addition to stratifying schools, a composite measure of size was used for school sample selection based on the number of students enrolled by race. This is different from the methodology used for NELS:88. The NELS:88 average school design effect in the base year study was considerably lower: 1.82.

The first follow-up design effects are lower for all respondents and for most of the subgroups than the base-year design effects. For the full sample, the design effect for males is the same as in the base year, the design effects for American Indian or Alaska Native and for multiracial respondents are greater than in the base year, and the design effects for the other 14 subgroups are lower than in the base year. For the panel sample, the design effects for American Indian or Alaska Native and for multiracial respondents are greater than in the base year, and the design effects for the other 15 subgroups are lower than in the base year.

The second follow up study design effects are lower for all respondents and for all of the common subgroups used in design effects calculations than the base-year and first follow-up design effects. The items used to compute the mean design effects were different in the third follow-up than in prior rounds because the design effects were not expected to change much across the four rounds of the study.

Nonsampling Error

Coverage error. In ELS:2002 base-year contextual samples, the coverage rate is the proportion of the responding student sample with a report from a given contextual source (e.g., the parent survey, the teacher survey, or the school administrator survey). For the teacher survey, the student coverage rate can be calculated as either the percentage of participating students with two teacher reports or the percentage with at least one teacher report. The teacher and parent surveys in ELS:2002 are purely contextual. The school-level surveys (school administrator, library media center, facilities checklist) can be used contextually (with the student as the unit of analysis) or in standalone fashion (with the school as the unit of analysis). Finally, test completions (reading assessments, mathematics assessments) are also calculated

on a base of the student questionnaire completers, rather than on the entire sample, and thus express a coverage rate. “Coverage” can also refer to the issue of missed target population units in the sampling frame (undercoverage) or duplicated or erroneously enumerated units (overcoverage).

Completed school administrator questionnaires provide 99.0 percent (weighted) coverage of all responding students. Completed library media center questionnaires provide 96.4 percent (weighted) coverage of all responding students. Of the 15,360 responding students, parent data (either by mailed questionnaire or by telephone interview) were received from 13,490 of their parents. This represents a weighted coverage rate of 87.4 percent.

Nonresponse error. Both unit nonresponse (nonparticipation in the survey by a sample member) and item nonresponse (missing value for a given questionnaire/test item) have been evaluated in ELS:2002.

Unit nonresponse. ELS:2002 has two levels of unit response (see table ELS-1): school response, defined as the school participating in the study by having a survey day on which the students took the test and completed the questionnaires; and student response, defined as a student completing at least a specified portion of the student questionnaire. The final overall school weighted response rate was 67.8 percent, and the final pool¹ weighted response rate was 71.1 percent. The final student weighted response rate was 87.3 percent. Because the school response rate was less than 70 percent in some domains and overall, analyses were conducted to determine if school estimates were significantly biased due to nonresponse.

Nonresponding schools (or their districts) were asked to complete a school characteristics questionnaire. The nonresponding school questionnaire contained a subset of questions from the school administrator questionnaire that was completed by the principals of participating schools. (Of the 469 nonresponding eligible sample schools, a total of 437, or 93.2 percent, completed the special questionnaire.

¹ The sample was randomly divided by stratum into two release pools and a reserve pool. The two release pools were the basic sample, with the schools in the second pool being released randomly within stratum in waves as needed to achieve the sample size goal. Also, the reserve pool was released selectively in waves by simple random sampling within stratum for strata with low yield and/or response rates, when necessary. Each time schools were released from the second release pool or the reserve sample pool, sampling rates were adjusted to account for the non-responding schools and the new schools.

The school and student nonresponse bias analyses, in conjunction with the weighting adjustments, were not successful in eliminating all bias. However, they reduced bias and eliminated significant bias for the variables known for most respondents and nonrespondents, which were considered to be some of the more important classification and analysis variables. The relative bias decreased considerably after weight adjustments, especially when it was large before nonresponse adjustment, and the relative bias usually remained small after weight adjustments when it was small before nonresponse adjustment).

Student-level nonresponse. For students, although the overall weighted response rate was approximately 87 percent, the response rate was below 85 percent for certain domains, so a student-level nonresponse bias analysis conditional on the school responding was also conducted. Some information on the characteristics of nonresponding students was available from student enrollment lists. On these lists, data were obtained on IEP status, race/ethnicity, and sex. These data were not provided by all schools (in particular, information on IEP status was often missing, and IEP information was typically relevant only for public schools). Consequently, only the school-supplied race/ethnicity and sex data, as well as the school-level data used in the school nonresponse bias analysis, were utilized in conducting the student-level nonresponse bias analysis.

For the student-level nonresponse bias analysis, the estimated bias decreased for every variable after weight adjustments were made. Therefore, the number of significantly biased variables decreased from 42 before adjustment to zero after adjustment.

Nonresponse bias analyses were conducted for the postsecondary transcript study, where response was defined as having a postsecondary transcript. Details for the nonresponse adjustment significance testing can be found in the ELS PETS Data File Documentation (Ingels et al. 2015).

Item nonresponse. There were no parent or teacher questionnaire items with a response rate that fell below 85 percent. However, there were 78 such items in the student questionnaire, including composites. Item nonresponse was an issue for the student questionnaire because, in timed sessions, not all students reached the final items. The highest nonresponse was seen in the final item, which was answered by only 64.6 percent of respondents.

At the school level, 41 administrator items had a response rate that fell below 85 percent (ranging from a high of 84.7 percent to a low of 74.6 percent). No library media center questionnaire items fell below the 85 percent threshold, nor did any facility checklist items. While the school-level items can often be used as contextual data with the student

as the basic unit of analysis, these items are also, with the school weight, generalizable at the school level. Therefore, for the school administrator questionnaire, nonresponse rates and nonresponse bias estimates have been produced at the school level. While item nonresponse in the student questionnaire reflects item position in the questionnaire and the inability of some students to reach the final items in a timed session, nonresponse in the school questionnaire must be explained by two other factors: first, the nature of particular items; second, the fact that some administrators completed an abbreviated version of the questionnaire (the high nonresponse items did not appear in the abbreviated instrument).

Measurement error. In the field test, NCES evaluated measurement error in (1) student questionnaire data compared to parent questionnaire data; and (2) student cognitive test data. See *Education Longitudinal Study: 2002 Field Test Report* (Burns et al. 2003).

Parent-student convergence. Some questions were asked of both parents and students. This served two purposes: first, to assess the reliability of the information collected; second, to determine who was the better source for a given data element. These parallel items included number of siblings, use of a language other than English, and parent/child interactions. Additional items on parents' occupation and education, asked in both the parent and student interviews, were also evaluated for their reliability.

Parent-student convergence was low to medium, depending on the item. For example, the convergence on number of siblings is low. Although both parents and students were asked how many siblings the 10th-grader had, the questions were asked quite differently. It is not clear whether the high rate of disagreement is due to parents incorrectly including the 10th-grader in their count of siblings, the inaccurate reporting of "blended" families, or the differences in how the questions were asked in the two interviews. The parent-student convergence on parents' occupation and education was about 50 percent, very similar to those of the NELS:88 base-year interview.

Reliability of parent interview responses. In the field test, the temporal stability of a subset of items from the parent interview was evaluated through a reinterview administered to a randomly selected subsample of 147 respondents. The reinterview was designed to target items that were newly designed for the ELS:2002 interview or revised since their use in a prior NELS interview. Percent agreement and appropriate correlational analyses were used to estimate the response stability between the two interview administrations. The overall reliability of parent interview responses varied from very high to very low, depending on the item. For example, the overall reliability for items pertaining to family composition and race and

ethnicity is high; the overall reliability for items pertaining to religious background, parents' education, and educational expectations for the 10th-grader is only marginally acceptable.

Cognitive test data. The test questions were selected from previous assessments: NELS:88, NAEP, and PISA. Items were field tested 1 year prior to the 10th- and 12th-grade surveys, and some items were modified based on field-test results. Final forms were assembled based on psychometric characteristics and coverage of framework categories. The ELS:2002 assessments were designed to maximize the accuracy of measurement that could be achieved in a limited amount of testing time, while minimizing floor and ceiling effects, by matching sets of test questions to initial estimates of students' achievement. In the base year, this was accomplished by means of a two-stage test. In 10th grade, all students received a short multiple-choice routing test, scored immediately by survey administrators who then assigned each student to a low-, middle-, or high-difficulty second-stage form, depending on the student's number of correct answers in the routing test. In the 12th-grade administration, students were assigned to an appropriate test form based on their performance in 10th grade. Cut points for the 12th-grade low, middle, and high forms were calculated by pooling information from the field tests for 10th and 12th grades in 2001, the 12th-grade field test in 2003, and the 10th-grade national sample. Item and ability parameters were estimated on a common scale. Growth trajectories for longitudinal participants in the 2001 and 2003 field tests were calculated, and the resulting regression parameters were applied to the 10th-grade national sample.

The scores are based on IRT, which uses patterns of correct, incorrect, and omitted answers to obtain ability estimates that are comparable across different test forms. In estimating a student's ability, IRT also accounts for each test question's difficulty, discriminating ability, and a guessing factor.

Data Comparability

As part of an important historical series of studies that repeats a core of key items each decade, ELS:2002 offers the opportunity for the analysis of trends in areas of fundamental importance, such as patterns of coursetaking, rates of participation in extracurricular activities, academic performance, and changes in goals and aspirations.

Comparability with NLS:72, HS&B, and NELS:88. The ELS:2002 base-year and first follow-up surveys contained many data elements that were comparable to items from prior studies. Some items are only approximate matches, and for these, analysts should judge whether they are sufficiently comparable for the analysis at hand. In other cases, question stems and response options correspond

exactly across questionnaires. These repeated items supply a basis for comparison with earlier sophomore cohorts (such as 1980 sophomores in HS&B and 1990 sophomores in NELS:88). With a freshened senior sample, the ELS:2002 first follow-up supports comparisons to 1972 (NLS:72), 1980 (HS&B), and 1992 (NELS:88). The first follow-up academic transcript component offers a further opportunity for cross-cohort comparisons with the high school transcript studies of HS&B, NELS:88, and NAEP.

Although the four studies have been designed to produce comparable results, they also have differences that may affect the comparability as well as the precision of estimates. Analysts should be aware of and take into account these several factors. In particular, there are differences in sample eligibility and sampling rates, in response rates, and in key classification variables, such as race and Hispanic ethnicity. Other differences (and possible threats to comparability) are imputation of missing data, differences in test content and reliability, differences in questionnaire content, potential mode effects in data collection, and possible questionnaire context and order effects.

Eligibility. Very similar definitions were used across the studies in deciding issues of school eligibility. Differences in student sampling eligibility, however, are more problematic. Although the target population is highly similar across the studies (all students who can validly be assessed or, at a minimum, meaningfully respond to the questionnaire), exclusion rules and their implementation have varied somewhat, and exclusion rates are known to differ, where they are known at all. For instance, a larger proportion of the student population was included in ELS:2002 (99 percent) than in NELS:88 (95 percent), which may affect cross-cohort estimates of change.

Sample design. Differences in sampling rates, sample sizes, and design effects across the studies also affect precision of estimation and comparability. Asian students, for example, were oversampled in NELS:88 and ELS:2002, but not in NLS:72 or HS&B, where their numbers were quite small. The base-year (1980) participating sample in HS&B numbered 30,030 sophomores. In contrast, 15,360 sophomores participated in the base year of ELS:2002. Cluster sizes within school were much larger for HS&B (on average, 30 sophomores per school) than for ELS:2002 (just over 20 sophomores per school); larger cluster sizes are better for school effects research, but carry a penalty in greater sample inefficiency. Mean design effect (a measure of sample efficiency) is also quite variable across the studies: for example, for the 10th grade, it was 2.9 for HS&B and 3.9 for NELS:88 (reflecting high subsampling after the 8th-grade base year), with the most favorable design effect, 2.4, for the ELS:2002 base year. Other possible sources of difference

between the cohorts that may impair change measurement are different levels of sample attrition over time and changes in the population of nonrespondents.

Imputation of missing data. One difference between the SES variable in ELS:2002 and in prior studies arises from the use of imputation in ELS:2002. Because all the constituents of SES are subject to imputation, it has been possible to create an SES composite with no missing data for ELS:2002. For the HS&B sophomores, SES was missing for around 9 percent of the participants, and for NELS:88 (in 1990) for just under 10 percent.

Score equating. ELS:2002 scores are reported on scales that permit comparisons with reading and mathematics data for NELS:88 10th-graders. Equating the ELS:2002 scale scores to the NELS:88 scale scores was completed through common-item, or *anchor*, equating. The ELS:2002 and NELS:88 tests shared 30 reading and 49 math items. These common items provided the link that made it possible to obtain ELS:2002 student ability estimates on the NELS:88 ability scale. Parameters for the common items were fixed at their NELS:88 values, resulting in parameter estimates for the noncommon items that were consistent with the NELS scale.

Transcript studies. ELS:2002, NELS:88, HS&B, and NAEP were designed to support cross-cohort comparisons. ELS:2002, NAEP, and NELS:88, however, provide summary data in Carnegie units, whereas HS&B provides course totals. In addition, unlike previous NCES transcript studies, which collected transcripts from the last school attended by the sample member, the ELS:2002 transcript study collected transcripts from all base-year schools and the last school attended by sample members who transferred out of their base-year school.

Other factors should be considered in assessing data compatibility. There are some mode-of-administration differences across the studies (for example, ELS:2002 collected 2006 data via self-administration on the web, as well as by CATI and CAPI; in contrast, NLS:72 and HS&B used paper-and pencil mail surveys). Order and context effects are also possible (questions have been added, dropped, and reordered, over time).

Comparability with PISA. A feature of ELS:2002 that expands its power beyond that of its predecessors is that it can be used to support international comparisons. Items from PISA were included in the ELS:2002 achievement tests. PISA, which is administered by the Organization for Economic Cooperation and Development, is an internationally standardized assessment, jointly developed by the 32 participating countries (including the United States) and administered to 15-year-olds in groups in their schools. ELS:2002 and PISA test instruments, scoring methods, and populations, however, differ in several

respects that impact the equating procedures and interpretation of linked scores.

Table ELS-1. Unit-level and overall weighted response rates for selected ELS:2002 student populations, by data collection wave: 2002 through 2012

Population	Base year school level	Base year student level	1st follow-up	2nd follow-up	3rd follow-up
Unit-level weighted response rate					
Interviewed students	67.8	87.3	93.4	88.4	83.8
Tested students	67.8	95.1	87.4	†	†
Transfers	67.8	†	68.4	81.6	†
Dropouts	67.8	†	73.2	83.1	85.4
Overall weighted response rate					
Interviewed students	†	59.2	63.3	59.9	73.0
Tested students	†	64.5	59.3	†	†
Transfers	†	†	46.4	55.3	†
Dropouts	†	†	49.6	56.3	64.8

† Not applicable.

SOURCE: ELS methodology reports; available at <https://nces.ed.gov/pubsearch/getpubcats.asp?sid=107>.

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7. METHODOLOGY AND EVALUATION REPORTS

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